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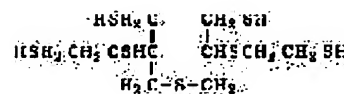
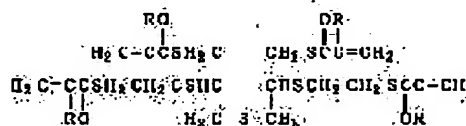
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(54) SULFUR-CONTAINING (METH) ACRYLATE COMPOUND AND ITS USE

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain a (meth) acrylate compound useful as an optical material improved in optical properties, high in refractive index and excellent in scratching resistance.

SOLUTION: This sulfur-containing (meth) acrylate compound is shown by formula I (R is H or methyl). The compound is obtained by reacting 1mol polythiol compound of formula II with 4-6mol (meth)acrylic acid chloride, etc. at -20 to 60° C. In order to remove hydrogen chloride evolving during the reaction, a base (e.g. trimethylamine) as a hydrogen chloride scavenger is preferably added to the reaction system. The compound of formula I is copolymerized with another monomer such as benzyl acrylate so that the content of the compound is ≥60wt.% based on the total of the compound and the monomer to give a sulfur-containing resin useful as an optical material.



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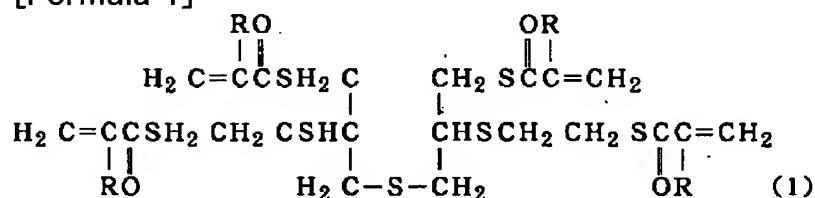
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CLAIMS

[Claim(s)]

[Claim 1] The sulfur-containing (meta) acrylate compound expressed with the following type (1) and (** 1).

[Formula 1]



(R expresses a hydrogen atom or a methyl group among a formula)

[Claim 2] The constituent for plastic lenses containing a sulfur-containing (meta) acrylate compound according to claim 1.

[Claim 3] The constituent for plastic lenses containing at least one sort of the monomer in which a sulfur-containing (meta) acrylate compound and copolymerization are possible, or the Pori thiol compounds according to claim 2.

[Claim 4] Sulfur-containing resin obtained by carrying out the polymerization of the constituent according to claim 2 or 3.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the sulfur-containing resin which is made to carry out the polymerization of a new sulfur-containing (meta) acrylate compound, the constituent for plastic lenses containing the compound, and its constituent, and is obtained.

[0002]

[Description of the Prior Art] A plastic lens is lightweight compared with an inorganic lens, cannot break easily, and since it can dye, it is spreading through optical elements, such as a spectacle lens and a camera lens, quickly in recent years. As resin widely used for current and these purposes, there are some to which the radical polymerization of the diethylene-glycol screw (allyl carbonate) (D.A.C is called hereafter) was carried out. This resin has the various descriptions -- workability, such as excelling in shock resistance, a lightweight thing, excelling in the dye affinity, cutting ability, and polish nature, is good. However, this resin has a refractive index as small as $n_D = 1.50$ compared with an inorganic lens ($n_D = 1.52$), in order to obtain an optical property equivalent to a glass lens, it is necessary to enlarge the main thickness of a lens, KOBA thickness, and curvature, and becoming thick on the whole is not avoided. For this reason, resin for lenses with a more high refractive index was desired.

[0003] D.A.C The polyurethane system lens is known as a lens with a refractive index higher than resin. this invention persons have proposed the polyurethane system lens which consists of a polymerization object of a xylylene diisocyanate compound and the Pori thiol compounds in JP,63-46213,A as this polyurethane system lens, and have spread widely as optical lenses, such as a lens for glasses. Moreover, the polyurethane system lens excellent in a light weight and shock resistance is proposed by JP,2-270859,A with the high refractive index with the combination of the specific Pori thiol compounds and an isocyanate compound. However, it has the fault that the lens by these resin does not have enough abrasion-proof nature, and the front face of a lens tends to get damaged. Moreover, in order to obtain a homogeneous lens optically, polymerization time amount might become long, and workability might become complicated. For this reason, the further amelioration was desired that these troubles should be solved.

[0004]

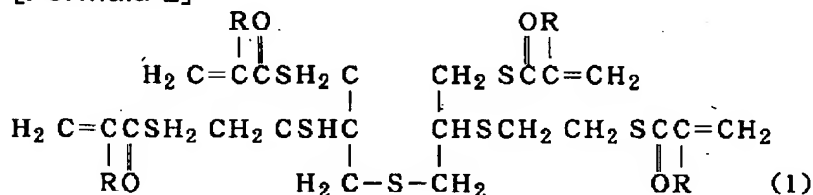
[Problem(s) to be Solved by the Invention] The purpose of this invention is offering the sulfur-containing resin for optical materials which is obtained by the short-time polymerization and has especially good optical physical properties, a high refractive index, and the abrasion-proof nature that was very excellent.

[0005]

[Means for Solving the Problem] this invention persons came to complete a header and this invention for the new sulfur-containing (meta) acrylate compound, as a result of inquiring wholeheartedly, in order to solve an above-mentioned technical problem. That is, this invention relates to the sulfur-containing resin which is made to carry out the polymerization of the sulfur-containing (meta) acrylate compound expressed with the following type (1) and (** 2), the constituent for plastic lenses containing the sulfur-containing (meta) acrylate compound expressed with a formula (1), and this constituent, and is obtained.

[0006]

[Formula 2]



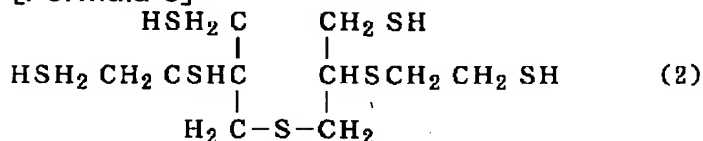
(R expresses a hydrogen atom or a methyl group among a formula)

[0007]

[Embodiment of the Invention] Hereafter, this invention is explained to a detail. The sulfur-containing (meta) acrylate compound of this invention can manufacture the Pori thiol compounds of four organic functions expressed with the following type (2) and (** 3) as a start raw material. The Pori thiol compounds shown by the formula (2) make the approach of a publication, i.e., epichlorohydrin and 2-mercaptoethanol, react to JP,7-252207,A, make the acquired diol object react with a sodium sulfide further, and acquire a tetra-all object. Subsequently, this tetra-all object is made to react with thiourea among a hydrochloric acid, and it is easily manufactured by the approach of hydrolyzing with aqueous ammonia.

[0008]

[Formula 3]



[0009] As opposed to one mol of Pori thiol compounds in which a sulfur-containing (meta) acrylate compound is shown by ** formula (2) The approach to which 4-6-mol acrylic-acid (meta) chloride etc. is made to react at -20 degrees C - 60 degrees C, 4-6-mol beta-chloro propionyl chloride or beta-chloro-alpha-methyl propionyl chloride is made to react at -20 degrees C - 80 degrees C to one mol of Pori thiol compounds shown by ** formula (2). Or subsequently It is manufactured by making a 4-8-mol base react at -20 degrees C - 60 degrees C.

[0010] In order to remove the hydrogen chloride generated in the case of a

reaction, a base can also be made to live together as a hydrogen chloride supplement agent in the system of reaction at the above-mentioned reaction. Although especially the base as a hydrogen chloride supplement agent is not limited, alkylamine, such as a trimethylamine and triethylamine, a pyridine, a sodium hydroxide, a potassium hydroxide, etc. are mentioned as a base generally used. As a base used at the reaction of the latter part of the aforementioned **, alkylamine, such as a trimethylamine and triethylamine, is more desirable. Moreover, in order to obtain the sulfur-containing (meta) acrylate compound of a high grade, it is desirable at high yield to carry out a direct reaction, removing the hydrogen chloride generated without making a base live together as a hydrogen chloride supplement agent in the system of reaction at the reaction of the preceding paragraph of the aforementioned ** out of a system.

[0011] Moreover, an organic solvent may be used if needed in the case of this reaction. Although especially the organic solvent used is not limited, what does not have the reactivity of raw materials required for a reaction can be used for it. As an organic solvent, ketones, such as ether, such as aliphatic series, such as benzene, toluene, a xylene, a hexane, a heptane, the petroleum ether, chloroform, a methylene chloride, and an ethylene chloride, aromatic hydrocarbon or halogenated hydrocarbon, diethylether, dioxane, and a tetrahydrofuran, an acetone, and a methyl ethyl ketone, N.N-dimethylformamide, etc. are mentioned, for example.

[0012] The constituent for plastic lenses of this invention contains the sulfur-containing (meta) acrylate compound expressed with said formula (1), and contains at least one sort of the sulfur-containing (meta) acrylate compound expressed with a formula (1) and the monomer in which this and copolymerization are possible, or the Pori thiol compounds. In the case of the constituent for plastic lenses containing other monomers or Pori thiol compounds, the sulfur-containing (meta) acrylate compound expressed with a formula (1) is 60 % of the weight or more more preferably 40% of the weight or more 20% of the weight or more to the monomer of a sulfur-containing (meta) acrylate compound and others, or the whole quantity of the Pori thiol compounds. In order that the monomer in which a sulfur-containing (meta) acrylate compound and copolymerization are possible or the Pori thiol compounds of this invention may adjust many physical properties, such as adjustment of optical physical properties, such as a refractive index, and shock resistance, specific gravity, in order to adjust the viscosity of a monomer, and the handling of others, it is chosen according to the purpose and especially limitation is not carried out. Moreover, the monomer in which these copolymerization is possible, or the Pori thiol compounds can also be used for two or more sorts by using it independently, mixing.

[0013] As a monomer which can be copolymerized, for example Benzyl acrylate, benzyl methacrylate, BUCHIKISHI ethyl acrylate, butoxy methyl methacrylate, cyclohexyl acrylate, Cyclohexyl methacrylate, 2-hydroxyethyl acrylate, 2-hydroxymethyl methacrylate, glycidyl acrylate, glycidyl methacrylate, Phenoxy ethyl acrylate, phenoxy ethyl methacrylate, Phenyl methacrylate, ethylene glycol diacrylate, ethylene glycol dimethacrylate, Diethylene glycol diacrylate, diethylene-glycol dimethacrylate, Triethylene glycol diacrylate, triethylene glycol dimethacrylate, Tetraethylene glycol diacrylate, tetraethylene glycol

dimethacrylate, Polyethylene-glycol diacrylate, polyethylene glycol dimethacrylate, Neopentyl glycol diacrylate, neopentyl glycol dimethacrylate, Ethylene glycol bis-glycidyl acrylate, ethylene glycol bis-glycidyl methacrylate, Bisphenol A diacrylate, bisphenol A dimethacrylate, 2 and 2-screw (4-AKUROKISHI diethoxy phenyl) propane, 2, and 2-screw (4-meta-KUROKISHI diethoxy phenyl) propane, Trimethylolpropane triacrylate, trimethylolpropanetrimethacrylate, Glycerol diacrylate, glycerol dimethacrylate, a pentaerythritol thoria chestnut rate, Pentaerythritol tetraacrylate, pentaerythritol tetra-methacrylate, Methylthio acrylate, methylthio methacrylate, phenylthio acrylate, Benzyl thio methacrylate, xylylene dithiol diacrylate, Xylylene dithiol dimethacrylate, mercapto ethyl sulfide diacrylate, Mercapto ethyl sulfide dimethacrylate, diallyl phthalate, Diaryl terephthalate, diallyl isophthalate, diaryl carbonate, diethylene-glycol bisallyl carbonate, styrene, chloro styrene, methyl styrene, bromostyrene, dibromo styrene, etc. are mentioned.

[0014] As Pori thiol compounds, moreover, 1, 2-ethane dithiol, 1, 3-propane dithiol, 1,2,3-propanetrithiol, 2, 3-dimercapto-1-propanol, A diethylene-glycol screw (2-mercapto acetate), a diethylene-glycol screw (3-mercaptopropionate), A trimethylol propane screw (2-mercapto acetate), a trimethylol propane screw (3-mercaptopropionate), Pentaerythritol tetrakis (2-mercapto acetate), pentaerythritol tetrakis (3-mercaptopropionate), 1, 2-dimercapto benzene, 1, 3-dimercapto benzene, 1, 4-dimercapto benzene, 1, 2-screw (mercaptomethyl) benzene, 1, 3-screw (mercaptomethyl) benzene, 1, 4-screw (mercaptomethyl) benzene, 1 and 2, 3-trimercapto benzene, 1, 2, 4-trimercapto benzene, 1 and 3, 5-trimercapto benzene, 1, 2, 3-tris (mercaptomethyl) benzene, 1 and 2, 4-tris (mercaptomethyl) benzene, 1, 3, 5-tris (mercaptomethyl) benzene, 4, and 4'-thio bis-benzenethiol, A screw (2-mercapto ethyl) sulfide, screw (2-mercapto ethyl thio) methane, 1, 2-screw (2-mercapto ethyl thio) ethane, 1, 3-screw (2-mercapto ethyl thio) propane, 1, 2, 3-tris (2-mercapto ethyl thio) propane, tetrakis (2-mercapto ethyl thiomethyl) methane, 1, a 2-screw (2-mercapto ethyl thio) 3-mercapto propane, 4, 8-screw (mercaptomethyl) - 3, 6, 9-TORICHIA -1, 11-undecane dithiol, 2, 5-dimercapto - 1, 4-dithiane, 2, 5-dimercaptomethyl -1, 4-dithiane, etc. are mentioned.

[0015] The sulfur-containing resin of this invention carries out the polymerization of said constituent, is obtained, and carries out copolymerization to the thing to which the polymerization of the sulfur-containing (meta) acrylate compound of this invention was carried out independently, the monomer which can copolymerize [other] a sulfur-containing (meta) acrylate compound, or the Pori thiol compounds. Especially as a polymerization method for obtaining the sulfur-containing resin of this invention, it is not limited and the well-known radical polymerization approach can be taken. As a polymerization initiation means in this case, the exposures of use of radical initiators, such as various peroxides and an azo compound, or ultraviolet rays, a visible ray, alpha rays, beta rays, a gamma ray, an electron ray, etc. or these concomitant use are mentioned.

[0016] A well-known thing can be used as a radical initiator. As a typical thing Benzoyl peroxide, dicumyl peroxide, lauroyl peroxide, A G t-butyl par OKISHIAZE rate, t-butylperoxy-2-ethylhexanoate, T-butyl peroxy laurate, t-butyl peroxybenzoate, T-butylperoxy-3,5,5-trimethyl hexanoate, t-butyl peroxyacetate,

Azo compounds, such as peroxides, such as screw (4-t-butyl cyclohexyl) peroxy dicarbonate and t-butylperoxyisopropylcarbonate, and azobisisobutyronitril, etc. are mentioned.

[0017] When irradiating ultraviolet rays etc. and making a polymerization start, a well-known sensitizer etc. can also be used. As a typical thing of a sensitizer, it is benzophenone, 4, and 4-diethylamino benzophenone, 1-hydroxy cyclohexyl phenyl ketone, p-dimethylamino isoamyl benzoate, 4-dimethylamino methyl benzoate, benzoin, benzoin ethyl ether, benzoin-isobutyl-ether, benzoin-iso-propyl-ether, 2, and 2-diethoxy acetophenone, methyl o-benzoylbenzoate, and 2-hydroxy. - 2-methyl-1-phenyl propane-1-ON, acyl phosphine oxide, etc. are mentioned.

[0018] A casting polymerization is mentioned as a typical polymerization method at the time of obtaining the sulfur-containing resin (for example, plastic lens) of this invention. That is, the constituent for plastic lenses of this invention containing a radical initiator, a sensitizer, or these both (it is also called monomer mixture) is poured in between the mold held on the gasket or the tape. At this time, if needed, even if it processes degassing etc., there is no inconvenience in any way.

Subsequently, ultraviolet rays etc. are irradiated, it can heat in oven, or these can be used together and stiffened, and a polymerization object can be taken out.

[0019] The polymerization method for obtaining the sulfur-containing resin of this invention, polymerization conditions, etc. cannot generally be limited with classes, such as an initiator to be used, an amount, and the class or rate of a monomer. For example, since it chooses the optimal temperature conditions in heating in oven since cooling etc. is processed in order to prevent overheating of monomer mixture when irradiating ultraviolet rays etc. and, temperature control may be carried out. When heating in oven, the method of heating gradually from low temperature, holding at an elevated temperature generally, and completing a polymerization is adopted. Moreover, since it is influenced also about the time amount of a polymerization with classes, such as an initiator to be used, an amount, and the class and rate of a monomer, it cannot generally *****. Generally, it is possible to aim at compaction of polymerization time amount by the exposure of ultraviolet rays etc.

[0020] In the case of shaping of the sulfur-containing resin of this invention, various matter, such as a chain elongation agent, a cross linking agent, light stabilizer, an ultraviolet ray absorbent, an antioxidant, the oil color, and a bulking agent, may be similarly added in the well-known fabricating method according to the purpose. Moreover, about the taken-out sulfur-containing resin, annealing etc. may be processed if needed.

[0021] The sulfur-containing resin obtained using the sulfur-containing (meta) acrylate of this invention is low distribution in a high refractive index, and has the description which was excellent in thermal resistance and weatherability and was very excellent in especially abrasion-proof nature. By changing the mold at the time of a casting polymerization, the sulfur-containing resin of this invention can be obtained as a Plastic solid of various gestalten, and can be used for various kinds of applications as optical element materials, such as a spectacle lens and a camera lens, and transparence resin. Especially, it is suitable as optical element materials, such as a spectacle lens and a camera lens. Furthermore, with the lens

using the sulfur-containing resin of this invention, since acid resisting, high degree-of-hardness grant, wear-resistant improvement, chemical-resistant improvement, fog resistance grant, or fashionability grant is improved if needed, physical or chemical preparation, such as surface polish, antistatic treatment, rebound ace court processing, nonreflective coat processing, dyeing processing, and modulated light processing, can be performed.

[0022]

[Example] Hereafter, an example and the example of a comparison explain this invention concretely. In addition, the following examining methods estimated a refractive index, the Abbe number, abrasion-proof nature, an appearance, and shock resistance among the performance tests of the obtained resin for lenses.

– A refractive index, the Abbe number : it measured at 20 degrees C using Pulfrich refractometer.

– Abrasion-proof nature : the front face of resin was rubbed by the steel wool of #0000, the surface difficulty of getting damaged was investigated, and it judged as follows.

O : -- **: which does not get damaged at all even if it rubs strongly -- x: which will get damaged a little if it rubs strongly -- outside of - to which weak friction also gets damaged It saw and observed by :viewing.

– Shock resistance : the iron ball was dropped from height of 127cm to a part for the core of the produced lens, and shock resistance was evaluated to it.

[0023] beta-chloro propionyl chloride 53.3g (0.42 mols) was taught to the reaction flask equipped with example 1 agitator, a thermometer, a dropping funnel, gaseous introductory tubing, and an exhaust pipe, and it warmed at 50 degrees C, circulating nitrogen gas gently. 36.7g (0.10 mols) of Pori thiol compounds of four organic functions shown by the formula (2) was dropped slowly, stirring. In this case, the occurring hydrogen chloride gas was absorbed in the trap of the sodium-hydroxide water solution besides a system. After dropping termination, it stirred at 50 degrees C for 6 hours, and the reaction was advanced. Next, having added toluene 300ml and cooling, the NaOH water solution was dropped 10%, and the inside of a system was made into alkalinity and was fully stirred. The organic layer was separated and it washed with water. The organic layer was taught to the reaction flask equipped with the agitator, the thermometer, and the dropping funnel, and triethylamine 44.5g (0.44 mols) was dropped gradually, cooling and stirring at 10 degrees C or less. It stirred at 25 more degrees C after dropping termination for 7 hours. Then, the reaction mixture was opened in water, and after separating liquids, dilute hydrochloric acid, a rare bicarbonate-od-soda water solution, and water washed the organic layer. After drying an organic layer with sulfuric anhydride magnesium, it distilled off under reduced pressure of toluene and 50.7g (0.087 mols) of the transparent and colorless target sulfur-containing acrylate compounds was obtained.

– ¹H-NMR (CDCl₃ the inside of a solvent, tetramethylsilane criteria)

delta=2.79–3.35 (m, 8H, and SCH₂ CH₂ S)

(m, 8H, and SCH₂ CHCH₂ S)

(m, 2H, and SCH₂ CHCH₂ S)

5.76 (m, 4H, and CH=CH₂)

6.35 (t, 8H, and CH=CH₂)

[0024] After having taught 36.7g (0.10 mols) of Pori thiol compounds of four organic functions, and acetone 300ml shown in the reaction flask of 4 openings equipped with example 2 agitator, the thermometer, and the dropping funnel by the formula (2), dropping 88g of NaOH water solutions 20%, cooling and stirring at 10 degrees C or less and fully stirring, methacrylic-acid chloride 46.0g (0.44 mols) was dropped gradually. It stirred after dropping termination for further 4 hours. Then, toluene 300ml and 200ml of water were added, and the resultant was extracted in the organic layer. After separating liquids and removing a water layer, a rare bicarbonate-soda water solution and water washed the organic layer. After drying an organic layer with sulfuric anhydride magnesium, it distilled off under reduced pressure of toluene and 48.3g (0.079 mols) of the transparent and colorless target sulfur-containing methacrylate compounds was obtained.

- 1 H-NMR (CDCl₃ the inside of a solvent, tetramethylsilane criteria)

delta= 1.97 (s, and 12H and CH₃-C)

2.79-3.35 (m, 8H, and SCH₂ CH₂ S)

(m, 8H, and SCH₂ CHCH₂ S)

(m, 2H, and SCH₂ CHCH₂ S)

5.60 (s, and 4H and C=CH₂)

6.24 (s, and 4H and C=CH₂)

[0025] It is 2-hydroxy as 25mg of t-butylperoxy-2-ethylhexanoate, and a sensitizer as a radical polymerization initiator to 50g of sulfur-containing acrylate compounds obtained in the example 3 example 1. - 2 - Methyl-1-phenyl propane-1-ON 50mg could be added, and it mixed. It poured into the mold mold which consists of glass mold and a gasket, after fully carrying out degassing of this. After irradiating ultraviolet rays for 5 minutes, cooling, the temperature up was carried out over 1 hour from 30 degrees C to 130 degrees C, it heated at 130 more degrees C for 1 hour, and the polymerization was performed. After polymerization termination, it cooled gradually and the Plastic solid was taken out from mold. The acquired Plastic solid (lens) was transparent and colorless, and were refractive-index $n_d = 1.642$ and Abbe number $n_{ud} = 33$. Moreover, it excelled also in abrasion-proof nature very much, and evaluation was "O."

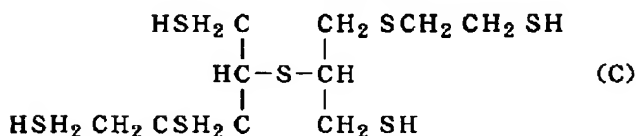
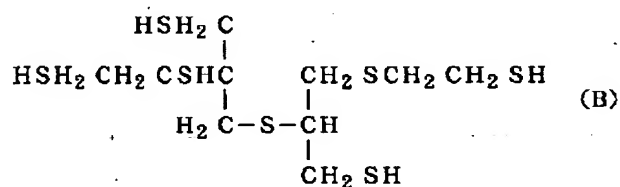
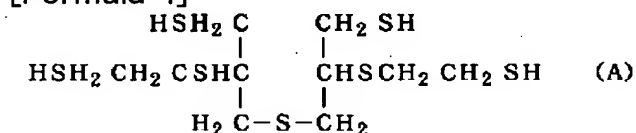
[0026] To 50g of sulfur-containing methacrylate compounds obtained in the example 4 example 2, 50mg of t-butylperoxy-2-ethylhexanoate could be added as a radical polymerization initiator, and it mixed. It poured into the mold mold which consists of glass mold and a gasket, after fully carrying out degassing of this. The temperature up was carried out over 2 hours from 30 degrees C to 130 degrees C, it heated at 130 more degrees C for 1 hour, and the polymerization was performed. After polymerization termination, it cooled gradually and the Plastic solid was taken out from mold. The acquired Plastic solid (lens) was transparent and colorless, and were refractive-index $n_d = 1.622$ and Abbe number $n_{ud} = 36$. Moreover, it excelled also in abrasion-proof nature very much, and evaluation was "O."

[0027] According to the example 1 of example 5 JP,7-252207,A, the mixture of the Pori thiol compounds of four organic functions shown by following type (A) - (C) and (** 4) was obtained. 36.7g (0.10 mols) of mixture of the Pori thiol compounds of four organic functions shown by these formulas was used, and 49.6g (0.085

mols) of mixture of the transparent and colorless sulfur-containing acrylate compound shown by following type (A') - (C') (** 5) was obtained like the example 1. It is 2-hydroxy as 20mg of t-butylperoxy-2-ethylhexanoate, and a sensitizer as a radical polymerization initiator to 40g of this sulfur-containing acrylate mixture. - 2 - Methyl-1-phenyl propane-1-ON 40mg could be added, and it mixed. It poured into the mold mold which consists of glass mold and a gasket, after fully carrying out degassing of this. After irradiating ultraviolet rays for 5 minutes, cooling, the temperature up was carried out over 1 hour from 30 degrees C to 130 degrees C, it heated at 130 more degrees C for 1 hour, and the polymerization was performed. After polymerization termination, it cooled gradually and the Plastic solid was taken out from mold. The acquired Plastic solid (lens) was transparent and colorless, and were refractive-index $n_d = 1.642$ and Abbe number $n_{ud} = 33$. Moreover, it excelled also in abrasion-proof nature very much, and evaluation was "O."

[0028]

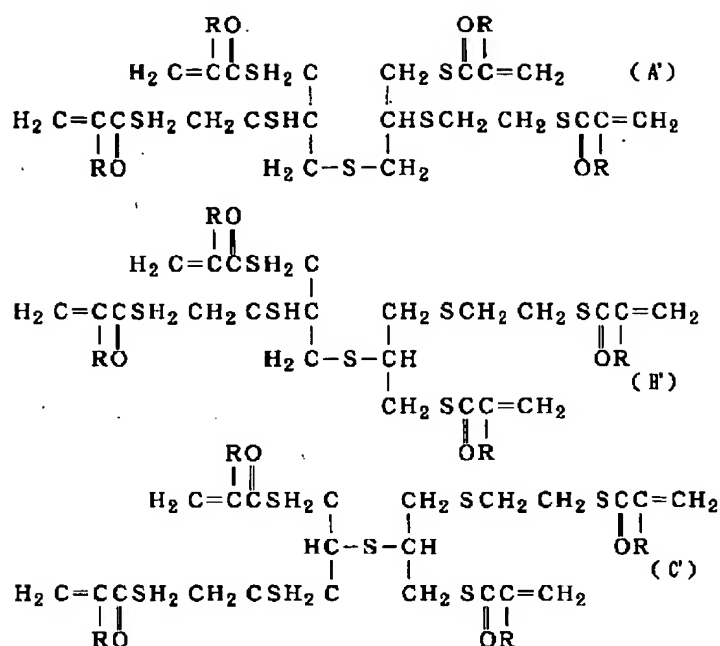
[Formula 4]



(A) / (B) / (C) = 85 / 5 / 10 (モル比) の異性体混合物

[0029]

[Formula 5]



(A')/(B')/(C') = 85/5/10 (モル比) の異性体混合物

[0030] It is 2-hydroxy as 50mg of t-butylperoxy-2-ethylhexanoate, and a sensitizer to 35g of sulfur-containing acrylate compounds obtained in the example 6 example 1 as 15g of equivalent mixture and the radical polymerization initiator of 1:1 of tetraethylene glycol dimethacrylate [the Shin-Nakamura Chemical Co., Ltd. make and NK ester 4G] and polyethylene glycol dimethacrylate [the Shin-Nakamura Chemical Co., Ltd. make and NK ester 14G]. - 2 - Methyl-1-phenyl propane-1-ON 100mg could be added, and it mixed. It poured into the mold mold which consists of glass mold and a gasket, after fully carrying out degassing of this. Since the viscosity of monomer mixture was low as compared with an example 3, impregnation was easy. After irradiating ultraviolet rays for 5 minutes, cooling, the temperature up was carried out over 1 hour from 30 degrees C to 130 degrees C, it heated at 130 more degrees C for 1 hour, and the polymerization was performed. After polymerization termination, it cooled gradually and the Plastic solid was taken out from mold. The acquired Plastic solid (lens) was transparent and colorless, and refractive-index $n_d = 1.592$, Abbe number $n_{ud} = 40$, and specific gravity were 1.31. It excelled also in abrasion-proof nature very much, and evaluation was "O." Shock resistance was improving rather than the resin obtained in the example 3.

[0031] It is 2-hydroxy as 50mg of t-butylperoxy-2-ethylhexanoate, and a sensitizer to 40g of sulfur-containing acrylate compounds obtained in the example 7 example 1 as 1 and 2-screw (2-mercapto ethyl thio) 3-mercapto propane 10g and a radical polymerization initiator. - 2 - Methyl-1-phenyl propane-1-ON 100mg could be added, and it mixed. It poured into the mold mold which consists of glass mold and a gasket, after fully carrying out degassing of this. After irradiating ultraviolet rays for 5 minutes, cooling, the temperature up was carried out over 1 hour from 30 degrees C to 130 degrees C, it heated at 130 more degrees C for 1 hour, and the polymerization was performed. After polymerization termination, it cooled gradually and the Plastic solid was taken out from mold. The acquired Plastic solid (lens) is transparent and colorless, and is refractive-index $n_d = 1.652$, and its refractive

index was improving considerably from the resin obtained in the example 3. Moreover, Abbe number $n_{ud} = 35$ and specific gravity were 1.37. It excelled also in abrasion-proof nature very much, and evaluation was "O." Shock resistance was improving rather than the resin obtained in the example 3.

[0032]

[Effect of the Invention] The sulfur-containing (meta) acrylate compound of this invention is a new compound, and the polymerization in a short time is possible for the constituent of this invention, and good optical physical properties, a high refractive index, and sulfur-containing resin with the abrasion-proof nature which was very excellent are given especially.

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